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ABSTRACT

One hundred and thirty-eight undergraudate college males were administered individual and group measures of perceptual field-independence. Most of these subjects were also administered two measures of intelligence and a battery of tests of creativity. Comparisons were made of the creative test performance of three groups of 15 subjects each, matched for Otis IQ and drawn from field-dependent, field-central, and field-independent subject categories. Similar comparisons were made with independent groups drawn from the same perceptual orientation groupings. It was predicted that field-independent subjects would obtain higher scores on tests of creative ability than would field-dependents. Individuals with field-independent cognitive styles were found to be consistently more creative on the tasks used in this study than individuals with field-dependent orientations. Factor analysis of all test scores for 114 subjects revealed six creativity factors and one factor composed of IQ and perceptual test scores. Significant relationships were found between individual and group measures of field-independence. Both measures of perceptual field orientation were correlated with factors commonly measured in intelligence tests. (BB)

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THE RELATIONSHIPS OF THE FIELD-DEPENDENT AND FIELD-INDEPENDENT COGNITIVE STYLES TO CREATIVE TEST PERFORMANCE[1]

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1967

[1]The authors express their gratitude to M. Erik Wright for the thoughtful ideas and helpful suggestions he provided in the discussion of the field-dependent and field-independent cognitive styles.

SUMMARY

One-hundred and thirty-eight undergraduate college males were administered individual and group measures of perceptual field-independence. Most of these Ss were also administered two measures of intelligence and a battery of tests of creativity. Comparisons were made of the creative test performance of 3 groups of 15 Ss each, matched for Otis IQ and drawn from field-dependent, field-central and field-independent S categories. Similar comparisons were made with independent groups drawn from the same perceptual orientation groupings. It was predicted that field-independent Ss would obtain higher scores on tests of creative ability than would field-dependents. A significant relationship was also predicted between Ss scores on the individual and group measures of field-independence. Individuals with field-independent cognitive styles were found to be consistently more creative on the tasks used in this study than individuals with field-dependent orientations. Significant differences between the creative test performance of these two S groups were obtained in both matched and independent group comparisons. Relationships between creativity and intelligence were found to be weak and typically nonsignificant. Factor analysis of all test scores for 114 Ss revealed six creativity factors and one factor composed of IQ and perceptual test scores. Significant relationships were found between individual and group measures of field-independence. Both measures of perceptual field orientation were

significantly correlated with factors commonly measured in intelligence tests. However, the degree of association between field-independence and IQ was highly influenced by the loadings of quantitative factors in the operational measures of intelligence employed. Some of the theoretical implications of these findings are discussed.

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The Relationship of Field-Dependent and Field-Independent Cognitive Styles to Creative Test Performance[2]

INTRODUCTION

In recent years psychologists have shown a growing interest in the study of cognitive styles, those stable and enduring patterns of personal consistency which find expression in widely diverse areas of the individual's functioning. As a result, one finds during the last two decades a rapidly accumulating body of information, theory and research focusing upon the identification of differing cognitive styles and the study of their relationships to personal functioning. Thus, Adorno et al (1950) have investigated the "authoritarian personality," Gardner and his colleagues (1959a, 1959b, 1960) have explored the patterning of "cognitive controls" which help the individual organize and mediate his transactions with the environment and Rokeach and his co-workers (1960) have concentrated research attention upon the behavioral correlates of individuals with "dogmatic" and "non-dogmatic" cognitive styles.

One of the most systematically investigated dimensions in this area of personality research has been the work done by Witkin and his associates (1954, 1962) in their studies of individuals with "field-dependent" and "field-independent" cognitive styles. Witkin began his work on this

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personality dimension in the late 1940's with a study (1950) of how the individual orients himself in space. The strikingly consistent patterns of individual performance which Witkin observed here triggered almost two decades of research on the personality-perception relationship and demonstrated convincingly that the individual's perceptual performance is related in a consistent way to highly diverse areas of cognitive life.

Most of Witkin's research has been based upon three perceptual tasks: the Body-Adjustment Test (BAT), the Rod-and-Frame Test (RFT) and the Embedded-Figures Test (EFT). Each of these three experimental situations requires the subject to keep an item (his body, a luminous rod, a geometric design) separate from the context of which it is a part. The subject is thus required to deal "analytically" with a field or configuration. The mode of perception which reflected the ability to deal with the "field" in this analytic fashion, to differentiate objects from embedding backgrounds, was designated by Witkin as Field-Independent.[3] The contrasting way of

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[3] In recent studies Witkin and his associates (1962) found that the field-dependent and field-independent styles of functioning, first identified in perceptual situations, was also manifested in intellectual activities as well. These workers felt that because of its very specific perceptual connotation, the label field-dependence-independence was much too limited in scope to encompass this more general cognitive style. Therefore, they adopted the term analytic field approach to refer to the style of individual functioning represented in perceptual and intellectual situations which required the ability to "break up" and overcome embedding contexts. The term global field approach was used to designate the style of functioning that involved submission to the dominant organization of the field and an inability to solve problems which required that contexts be overcome. These styles of functioning thus represent two contrasting ways of approaching a field whether the field is immediately present in perception or represented only symbolically.

The present research focuses upon the high level symbolic activity represented in creative behavior. However, the terms "field-dependent" and "field-independent" are used throughout the paper to characterize the two basic styles of cognitive functioning under investigation. Witkin's earlier terminology was used for greater ease in communicability. Witkin's

perceiving which reflected submission to the dominant organization of the field and inability to keep an item separate from its context was designated as Field-Dependent.

The Field-Dependent and Field-Independent Cognitive Styles and Creativity

Although subsequent research since Witkins's early studies has demonstrated that the perceptual functioning of field-dependent and field-independent individuals is related in a meaningful and coherent way to broad and highly diverse aspects of cognitive functioning which encompass the intellectual, emotional, social, motivational and even defensive life of the person, there has been almost no research relating these modes of perceptual orientation to the process of creativity (Witkin, 1965; MacKinnon, 1962; Crutchfield, et al, 1958). In some respects this is surprising since Witkin discussed these relationships, albeit briefly, in his early book, Personality through Perception (1954). Although Witkin did not formulate specific hypotheses concerning these relationships, he did note that Wertheimer (1945) had presented a conceptual model which provided possible linkages between these two modes of cognitive functioning and creative expression. Wertheimer had indicated that the ability to "break up" and reorganize configurations in problem-solving tasks might also be evidenced in situations calling for creativity, since ". . . problems that call for a high degree of creative activity . . . also require that the 'parts' be separated from the contexts in which

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more recent concepts might be just as applicable. However, in view of the weak and nonsignificant relationships which have been found between creativity and tests of intellectual ability (Yamamoto, 1962, 1965) one may question whether, strictly speaking, the terms "analytic field approach" and "global field approach" would be appropriate in the present research.

they are embedded and brought into new relationships" (p. 477).

The formulation and presentation of the hypotheses on the relationships between field-independence and creativity may best be facilitated by briefly considering what is "known" about Field-Dependent and Field-Independent Cognitive Styles.

In a recent book, Witkin and his colleagues (1962) summarized the bulk of research conducted on the Field-Dependent--Field-Independent Personality during the last decade. From these varied studies stable consistencies in functioning and adjustment of these individuals have begun to emerge. The general characteristics of these two differing cognitive styles may be summarized as follows.

Field-dependent or "global-field" perceptual performers are described as individuals who lack a well-developed sense of their own identity and separateness from others. During their development these individuals have failed to internalize a stable set of standards with which they can interpret and react to the world. Lacking stable internal frames of reference, field-dependents have great difficulty maintaining their own "direction" in the face of contradictory expressions from other people. Consequently, they look to others for support and reassurance and are highly vulnerable to external influence, particularly from authoritative figures. Global-field persons are postulated to be unable to organize and impose structure upon ambiguous stimuli. When thrown upon their own resources or faced with new and/or unusual situations, they tend to become "disrupted" and respond with ineffectual behavior. These individuals show a low awareness of their own "inner life" and are fearful of their own aggressive and sexual impulses. They characteristically utilize "primitive"

modes of defense such as denial and repression. Consequently, they tend to be somewhat anxious and "impulsive" and frequently become confused and disorganized under stress. They lack "cognitive clarity" and tend to experience themselves and the world in a vague, blurred and unorganized fashion.

While diffuse and poorly integrated functioning seems to characterize the adjustment of the field-dependent individual, the field-independent person falls at the other extreme on these personality dimensions. That is, field-independent or "analytic-field" perceptual performers are described as having a highly developed sense of their own self-identity. They tend to be regarded by others as socially more independent than their field-dependent counterparts and evidence a ready capacity to function with little environmental support. Field-independents effectively organize and structure vague or ambiguous stimuli and are likely to adopt a relatively intellectual and impersonal approach to problems. They are not markedly influenced by authorities but tend rather to be guided by their own standards, values and needs even to the point of being isolated from other people. These individuals evidence a relatively high awareness of their own motives and feelings and are acceptant of their own aggressive and sexual impulses. In their adjustment, field-independents tend to use relatively specialized and complex defenses such as isolation and intellectualization. Consequently, they may be somewhat detached and obsessive and are sometimes described as "overcontrolled." They show greater cognitive clarity than global-field individuals and tend to experience themselves and the world in a discrete, organized and articulate fashion.

What is the nature of creativity and how is it related to field-

dependent and field-independent cognitive styles? There are a number of divergent theories of the human creative process. However, most theorists agree that creativity is a process interrelating the person with his world, a sensuous and at times even "jarring" personal encounter between the individual and the world of objects and other people. A number of theorists, especially Adler (Ansbacher and Ansbacher, 1956), Fromm (1959), Rogers (1959), May (1959), Mackler and Shontz (1965), Schachtel (1959), Tumin (1954) and Wertheimer stress that the creative individual is highly sensitive to his environment. He is more open to it; he is moved and sensitive to what is happening in his world. In addition, most theorists agree that creative individuals evidence a need and capacity to "toy" with, reorganize, restructure and integrate divergent and even contradictory elements of experience.

The field-dependent person shows rather remarkable responsiveness to environmental influence. He lives in close proximity to, and is frequently swept by, the kaleidoscopic range of feelings, moods and emotions which constitute the raw ingredients of creative experience. However, he has only a limited awareness of his own impulse life and has great difficulty in structuring his experiences into meaningfully organized patterns or part-whole relationships. Moreover, his easily mobilized anxieties, strong needs for external support and reassurance, and difficulties in handling the "new" and "unusual" are factors which sharply limit his ability to participate fully in a creative enterprise. Thus, although the field-dependent person is highly sensitive to his environment, he is also "victimized" by it and lacks the capacity to effectively organize and integrate both inner experiences and environmental events.

The field-independent individual, on the other hand, is said to show a greater and more articulated awareness of his own inner experiences and environmental events. While he lacks the symbiotic openness of the field-dependent person, he is described as having an unusual capacity to "break up" experiences and to remold and reconstitute them in new patterns and configurations. In addition, the field-independent evidences the kind of autonomy and freedom from societal restraints which may be necessary for a genuine or creative encounter with the environment.

Basically, then, the present study is predicated upon the assumption that the relatively high-level organization and personal differentation which characterize the functioning of the field-independent individuals and the vague, blurred and labile mode of functioning which characterizes field-dependent ones will be reflected in their creative test performance just as they are evidencedin other areas of these individuals' personality functioning.

More specifically, the hypothesis to be tested in this part of the study may be stated as follows:

H_1: College males who demonstrate a field-independent performance on the Embedded-Figures Test (EFT), the criterion measure of field-independence used in the study, will obtain significantly higher creativity scores on the experimental measures of creative thinking abilities than will college males who demonstrate a field-dependent perceptual performance on the EFT.

Most personality theorists, particularly Maslow (1959), Kubie (1958), Fromm (1959) and Rogers (1959) assert that creativity occurs in

the mature, well-adjusted, and "fully functioning" person. These writers agree that personal maladjustment and pathology handicap the individual in his efforts at creative expression. However, Witkin et al (1962) have been quick to indicate that neither field-dependents nor field-independents exemplify paragons of balanced adjustment, personality integration or maturity. Thus, a field-independent orientation is not conceived as implying better adjustment, adaptation to life situations or the absence of pathology. Witkin reports that severely maladjusted and even pathologically disturbed individuals are found in groups utilizing either mode of field orientation.

In view of these facts, it seemed conceivable that individuals whose performances on Witkin's tasks fell somewhere in the mid-range on this personality dimension might more effectively integrate the intellectual and emotive components of the creative process than individuals at either extreme. To assess this possibility, it seemed desirable to gather creativity data on individuals who occupied some "middle-ground" position between these two polar extremes. Therefore, the creativity performance of field-central individuals was also explored in the study.

Although the primary aim of the present study was to compare the creative test performance of field-dependent and field-independent college men, the study also investigated two other methodological issues which repeatedly confront workers doing research with the field-dependence-independence personality dimension. The two secondary aims of the study were: (1) to assess the validity of a recently developed group measure of the field-independence personality construct, and (2) to investigate the problem of the relationship of the Witkin measures of

field-independence to intelligence test performance.

Group Versus Individual Measures of Field-Independence

While Witkin's empirical measures of field-independence permit a higher degree of precision in subject selection than many other measures currently used in personality research, the use of all three experimental procedures is a costly, laborious and time-consuming process. Since field-dependent and field-independent individuals are, by definition, persons whose performances place them at the polar extremes of this personality dimension, selection of subjects for this kind of research often demands screening of relatively large subject populations. The time investment required to do this is frequently impractical for many studies because it is difficult to enlist and retain large samples for the extensive individual testing that is required. If college students are used, which is frequently the case in personality research, the researcher must contend with recurrent problems of attrition due to dropouts, loss of interest, failure to keep appointments, etc. Often by the time the investigator has completed the initial screening he finds that many subjects which he needed are simply no longer available.

These kinds of practical concerns have led investigators to search for more economical measures of the field-dependence-independence personality variable. Some investigators have used combinations of two of Witkin's experimental tasks as the basic criterion of field-independence (Linton, 1952; Linton and Graham, 1959). Other workers have utilized the Rod-and-Frame Test (Crutchfield, Woodworth and Albrecht, 1958; Gross, 1959) alone or some variation of the Gottschaldt or Thurstone Figures (Honigfeld and Spiegel, 1960; Jackson, 1956). Still other investigators

have relied upon the Embedded-Figures Test (Bieri, 1960; Iscoe and Carder, 1961; Rosner, 1957) as their basic measure of perceptual field-independence. This measure correlates substantially with Witkin's other procedures and requires only a modest investment in materials and apparatus.

Recently, Jackson et al (1962) constructed a series of group administered embedded-figures (The Hidden Figures Tests) in the hope of developing a reliable and economical measure of this personality construct. Three different tests were developed which were structurally similar to Witkin's EFT. These measures were constructed so that the effects of individual versus group administration, colored versus achromatic designs and task requirements of memory versus non-memory elements could be assessed. While all three procedures correlated substantially with Witkin's individually administered Embedded-Figures Test, these workers concluded that more definitive research with specific tests would be necessary before the validity of the various group procedures could be evaluated adequately.

The present study proposed to evaluate the relationships between the individually administered Short Form of the Embedded-Figures Test (Jackson, 1956), the criterion measure of field-independence used in the present study, and the most promising form of the group administered Hidden Figures Tests described above. The group measure of field-independence, Form V of the Hidden Figures Test, used achromatic designs with a memory format. It consisted of sixteen embedded-figures in a booklet with complex designs presented on one side of a page and a simple figure on the obverse side. Administration procedures for the group measure were very similar to those Witkin developed for the individually administered EFT. The scores, however, consisted of the number of

figures correctly identified within a ten-minute test period. The hypothesis to be tested in this part of the study may be stated as follows:

H_2: College males who earn low solution time scores on the individually-administered Embedded-Figures Test will tend to obtain relatively high scores on the group administered Hidden Figures Test. Conversely, college males who earn high mean solution time scores on the EFT will tend to obtain low scores on the HFT.

Field-Independence and Intellectual Ability

The results of a number of independent studies have indicated that Witkin's indices of field-independence are highly correlated with intelligence factors. Thus, in a study with 12-year-old children, Woerner and Levine (1950) found a significant relationship between Witkin's perceptual battery and scores on the WISC Test. The degree of relationship between IQ and field-independence tended to be influenced by at least two factors. First, measures of field-independence tended to show a higher degree of association with Performance Scales on the WISC than with Verbal ones. Secondly, the correlation varied considerably depending upon which index of field-independence was employed. Thus, with the Embedded-Figures Test the correlation with WISC Total Scores was .71 for males and .74 with females while with the Body Adjustment Test the relationships were markedly lower, .31 and -.39 for males and females respectively.

In a later study with the Binet Test, Witkin (1962) also reported a significant relationship between IQ scores and perceptual index scores for ten-year-old boys ($r = .57$) and girls ($r = .76$). A number of other

investigators (Linton, 1952; Jackson, 1956; Podell and Phillips, 1959) subsequently confirmed the relationship between perceptual field-independence and measures of performance on a variety of standard intelligence tests.

Recently, Goodenough and Karp (1961) attempted to isolate the relationship between these variables. These workers factor-analyzed a matrix of intercorrelations among scores for the three Witkin procedures, the WISC, and a series of specially devised cognitive tasks. From their analyses, these investigators concluded that the superiority of the field-independent individual on IQ tests results specifically from his better performance on those parts of the intelligence tests which, like the perceptual tasks themselves, required "analytical" functioning or the ability to overcome embedding contexts.

In view of these facts and the accompanying questions which they raised, it was felt that some assessment of intelligence factors would be necessary to obtain any kind of clear or unambiguous results in the present study. Therefore, measures of intellectual ability were administered to all subjects who participated in the present research.

Two different measures of intellectual ability were obtained for subjects in this study. The first measure employed was the Gamma Form of the Otis Quick Scoring Test of Mental Ability (Otis, 1954). This intelligence test correlates well with other group and individual intelligence scales (Sartain, 1946) and has test-retest reliabilities comparable with other group measures of intelligence. Otis IQ scores were obtained for all subjects participating in this study. Secondly, for most subjects scores from the Schools and College Abilities Tests (SCAT, 1957) were

also available. The use of this intelligence scale had some unique advantages in the present study because it provided a Verbal Score Measuring vocabulary and reading comprehension; a Performance Score measuring numerical reasoning and understanding of arithmetical operations, and a Total Score composed of the sum of the two subscales. It was anticipated that if Witkin's hypotheses about the relationship of intelligence factors to mode of perceptual field orientation were valid, then subjects' Embedded-Figures Test performances should be more closely related to the Performance Scores on the SCAT than to the Verbal Scores on this test. If this were demonstrated, it might provide some indirect support for Witkin's rationale concerning the relationship between field-independence and intellectual ability.

METHOD

Measures

Measures of Field-Independence

Perceptual field-independence was first defined in terms of an individual's performance on three individually administered spatial orientation procedures, each requiring S to adjust an object or his body to the upright in the face of conflicting information from visual and proprioceptive cues. Later, Witkin discovered that an individual's performance upon an individually administered Embedded-Figures Test, developed from the Gottschaldt Figures, correlated high enough with the other laboratory procedures to suggest its use as a measure of field-independence. Ultimately, the Embedded-Figures Test (EFT) along with the Body-Adjustment Test (BAT) and the Rod-and-Frame Test (RFT) came to be

the standard measures of field-independence used in all of Witkin's research.

The empirical measure of field-independence employed in the present study was the Jackson (1956) Short Form of the Witkin Embedded-Figures Test. In this study, references to "field-dependence" and "field-independence" refer specifically to Design Field-Independence, i.e., those aspects of the field-independence construct measured by Embedded-Figures Test performance.

Two measures of Design Field-Independence were used in the study. Each S was administered the Short Form of the Witkin Embedded-Figures Test and also a more recently developed Hidden Figures Test (Jackson, et al, 1962).

The Embedded-Figures Test (EFT)

The Jackson Short form of the Witkin Embedded-Figures Test was individually administered to all Ss participating in the study. This test is based upon one test trial on twelve of the twenty-four embedded figures used in the original Witkin Battery. Administration and scoring procedures are essentially the same with both tests. Ss scores on the test are based upon the time (in seconds) taken to locate the simple figure within the twelve complex designs. Rapid solution time scores with the designs are reported as indices of field-independence while slow solution time scores indicate field-dependence.

Although the number of items on the Short Form of the EFT has been reduced and the test time limits shortened, the Jackson Short Form of the Embedded-Figures Test correlates in the mid-nineties with Witkin's EFT and has a test-retest reliability of .92 (Dana and Goocher, 1959). These data and the corroborative work of a number of investigators who

have used the Short Form (Bauman, 1951; Jackson, 1956; Podell and Phillips, 1959) indicate the shorter EFT to be a valid, reliable and economical measure of those processes tapped by Witkin's original EFT.

Ss' task on the Embedded Figures Test is to locate a simple figure hidden within a larger embedding design. The same simple figure is never the same on any two successive trials. Consequently, at the beginning of each trial S is never sure which simple figure he will be asked to find within.

S was given the following instructions:

> I am going to show you a series of colored designs. Each time I show you one of these designs, I want you to describe the overall pattern you see in it. After you examine each design, I will show you a simple figure which is contained in that larger design. You will then be given the larger design again, and your job will be to locate the simple figure in it. Let us go through one to show you how it is done.

S was then shown the practice complex design (P-1) for fifteen seconds. The practice design was removed and the practice simple figure (P) was shown for ten seconds. When it was removed, S was again presented with the complex figure and was asked to locate the simple figure in it. When the single practice trial was completed, the following additional instructions were given:

> This is how we will proceed on all the designs. I would like to add that in every case the smaller figure will be present in the larger design. It will always be present in the upright position. There may be several of the smaller figures in the same larger design, but you are to look only for the one in the upright position. Work as quickly as you possibly can, since I will be timing you; but be sure that the figure you find is exactly the same as the original figure both in size and proportions. As soon as you have found the figure say "Stop" so I will know when you see it. Then pick up the stylus and trace the outline of the figure so I know where you see it. When you have outlined the figure lay the stylus aside until you are ready to trace the figure on the next design. If you ever forget what the small figure looks like, you may ask to see it again. Are there any questions?

When all questions had been answered, S was presented with the first trial design and was asked to describe briefly the overall pattern he saw in it. The procedure of presenting the complex figure first and using a different simple figure on each trial was to impress the total complex pattern on S and to discourage the attitude of searching for a specific simple figure. A standard stopwatch was used to time each test trial. This same presentation procedure was followed on all twelve test designs.

Scores for each trial design consisted of the time (in seconds) which S required to locate the simple figure contained in the complex design. A maximum of three minutes was allowed for each design, and if S failed to locate the figure within that time limit his score was recorded as 3' (Fail). While S was searching for the simple figure, he was permitted, on request, to re-examine the copy of it as often as he wished. Witkin et al (1954) asserted that this is necessary, because the task would cease to be the one intended if S no longer remembered the structure of the embedded figure. Whenever S requested to re-examine the simple figure, the complex one was removed so that both figures were never seen simultaneously. S was not permitted more than ten seconds for any one re-examination. The stopwatch was stopped during the period of re-examination so that this time was not included in the final score.

If, during any given trial, S gave up his search and stated, "I give up," "I can't see it," or "It's not there," the experimenter said nothing but allowed the stopwatch to continue. In cases where S offered an incomplete or incorrect figure for the correct one, the examiner asked if the figure S had selected was exactly like the one he had just seen. If S stated again that the incomplete or incorrect figure was the

model figure, the examiner said nothing but allowed the stopwatch to continue until S either found the correct simple figure or the three minute time limit had elapsed. If S picked up the stylus and attempted to use it to trace the simple figure, he was asked to put it aside until he had actually discovered the simple figure.

When S reported the discovery of the simple figure within the complex design, the time was recorded on a record sheet but the stopwatch was permitted to continue while S traced out the simple figure. Thus, if S did trace the correct figure, the score recorded for the trial was the "time of discovery." However, if the correct figure was not traced, S continued his search and the time consumed in tracing the incorrect figure was included in his final score. This procedure was continued until S either located and traced the simple figure embedded within the complex one or he exceeded the three minute time limit.

S scores on the Embedded-Figures Test consisted of the time (in seconds) taken to locate the simple figure in all twelve complex trial designs. These twelve time scores were summed to provide a total time score for each individual. Total time for administration of the Embedded-Figures Test was approximately forty-five minutes per S.

The Hidden Figures Test (HFT)

The Hidden Figures Test (Jackson et al, 1962), a recently developed group measure of Design Field-Dependence-Independence, consists of a booklet of sixteen complex designs with a simple figure contained in each embedding design. High scores on this test are presumably indicative of field-independence, while low ones are indicative of field-dependence. This test was administered to all Ss in groups ranging in

size from five to fifty persons.

The examiner told S he would read the instructions printed on the front of the booklet aloud, while they read the instructions to themselves:

> This is a Hidden Figures Test. Each of the sixteen problems in this test is made of two designs, a complicated figure on the first page and a simple figure on the next. In each problem the simple design is contained in the complicated design. You are to find where the simple design is contained in the larger design and sketch it in over the lines of the figure with the pencil provided you. On the front of your test booklet is an example of a complicated design figure, a simple figure, and the complicated figure shown again with the simple figure sketched in. The smaller figure is always present in the larger figure and is always in the upright position. Be sure the figure you find is exactly the same as the simple figure, both in size and proportion. Work as carefully and as systematically as you can. If you forget the simple figure you may look back at the model to check it briefly. If you feel that you cannot solve one of the figures, you may skip it and come back to it later if you have time but you will waste time if you keep skipping from figure to figure. Do not worry about erasing completely if you have one or two incorrect lines, but be sure that you have all of the correct ones clearly indicated. Are there any questions?

When all questions had been answered, S was instructed to begin the test. At the end of ten minutes he was told to stop. S scores for the Hidden Figures Test consisted of the number of hidden figures correctly identified during the ten minute period. Total time for administration of the Hidden Figures Test was fifteen minutes.

Measures of Intellectual Ability

Two different indices of intellectual ability were used in the investigation. The first measure of intellectual ability consisted of the IQ scores obtained from the Revised Gamma Form (Em) of the Otis Quick Scoring Mental Abilities Test (Otis, 1954). This instrument was administered to S in groups ranging in size from 25 to 50 Ss.

The second measure of intellectual ability was Ss' score on the School and College Ability Tests (1957) which all Kansas University students take

on admission to the university.[4] Three scores are computed from this test: a Verbal Score measuring vocabulary and reading comprehension, a Quantitative Score measuring numerical reasoning and understanding of arithmetical operations, and a Total Score based upon the combination of the individual's Verbal and Quantitative Scores.

Measures of Creative Thinking Abilities

Four tests, developed by Torrance (1962) and Guilford and Merrifield (1960), made up the battery. Two verbal tests and two non-verbal tests were included, in order to sample a range of varied stimuli and responses.

The verbal tests were both developed by Torrance (1962). The tests, Ask and Guess and Tin Cans, take respectively fifteen minutes and five minutes to administer. Although both tests call for verbal responses, their formats differ considerably. Ask and Guess consists of a Mother Goose story, "Tom the Piper's Son," presented to S in pictorial form. The non-verbal stimulus is presented and S is asked to write about the causes and events concerning this Mother Goose tale. In the picture, Tom is shown running with a black and white pig in his arms, cap blowing off. The gate of the pigpen has been left open; one of the remaining pigs is looking up while the others are busy eating. A figure in the background is running toward the pen with a pitchfork in his hand. The dress of the human figures and the structures appear to be of medieval vintage.

S is asked to study the picture. Three parts follow with time limits of five minutes per section for a total time of fifteen minutes. S is told that this is a test of how curious he is about the world in which

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[4] These scores were made available through the courtesy of E. Gordon Collister of the University of Kansas Guidance Bureau.

he lives and of how good he is at guessing causes and results of an event. In introducing the first part, the examiner states that the main way we show our curiosity and obtain information is by asking questions. S is then instructed to think of all the questions he can about what he sees in the picture. He is encouraged to ask as many questions as he can about any or all parts of the picture and of the events depicted; at the same time he is cautioned to ask only those questions which cannot be answered by looking at the picture. In asking for hypotheses concerning causes (Part II), S is told that he cannot always obtain the information he wants by asking questions, and that there are times when he must make guesses and test his guesses through further investigation or study. He is then instructed to make all of the guesses he can concerning the possible causes of the event depicted. Similarly for Part III, S is instructed to give as many possible consequences (both immediate and long-range) as he can of the action depicted in the picture.

The Tin Cans test is a verbal task calling for verbal response to a verbal stimulus. S is simply instructed to "think of some unusual uses of tin cans." S is asked to list the cleverest, most interesting, and most unusual uses of tin cans. The tin cans may be of any size, and S can change them in any way that tin cans can be changed. The time limit is five minutes.

The remaining two tests call for non-verbal responses to non-verbal stimuli. The tests are the Circles test developed by Torrance (1962) and the Decorations test developed by Guilford and Merrifield (1960). The Circles test consists of an answer sheet with 36 circles (1" diameter) in six rows, six to a row. S is instructed to see how many objects he can

draw from the circles. The instructions state: "A circle should be the main part of whatever you make. With a pencil add lines to the circles to complete your picture. Your lines can be inside and outside the circles. Try to think of things that no one else in the room will think of. Make as many things as you can and put as many ideas as you can in each one. Add labels or titles if the identity of the object is not clear." A time limit of ten minutes is imposed on this test.

The remaining test, the Decorations test, consists of outline drawings of objects. S is asked to decorate the objects in any way he wishes. A page of instructions with examples of decorations precedes the task. S is instructed to make different decorations for the objects in the picture. Artistic quality is not important, and S is told this. There are two parts to this test: one part consists of two identical outlines of home interiors, and one part consists of two identical outlines of a cowboy. S is carefully instructed to make different decorations for each of the two identical outline drawings. The time limit is six minutes, three minutes for each part. S is told when half the time (1 1/2 minutes) has passed for a particular part.

Ask and Guess and Decorations seem rather straightforward and concrete, requiring relatively little meditation and concentration, while the Circles and Tin Cans are more difficult and abstract in the type of response demanded. The four tests were therefore presented in the following order: Ask and Guess, Circles, Decorations, and Tin Cans. The aim was to offset any set of difficult or easy tests by alternation. Time for administration for all four of the tests was 40 minutes, and the time and test procedures devised by Torrance (1962) and Guilford and Merrifield

(1960) were used.

In the test battery, an introductory page described the overall desired manner to approach the tests. It stated, "The tasks in this booklet are a test of your ability to use your imagination, to think of new ideas. There are no 'right' answers in the usual sense. We want you to think of as many ideas as you can. Try to think of unusual, interesting, and clever ideas--something which no one else in the room will think of. You will be given several tasks to do and you will be timed on each one, so do not waste time. Work as rapidly as you can with comfort. If you run out of ideas before time is called, wait until instructions are given before going on to the next task."

Responses were scored according to guidelines outlined by Torrance et al (1960) and Yamamoto (1962). The Decorations test developed by Guilford called for scoring procedures that appeared restricted in concept and which were also inconsistent with Torrance's scheme. Scoring procedures akin to Torrance's were therefore developed for this test. There were four scores: fluency, flexibility, elaboration, and originality.

Three scores were obtained for Ask and Guess, four for Circles, and three for Tin Cans. The Ask and Guess had three scores: fluency, adequacy, and flexibility. The Circles test had four scores identical to the Decorations: fluency, flexibility, elaboration, and originality. The Tin Cans test had three scores: flexibility, fluency, and originality.

Subjects

The Ss for the present study consisted of one hundred and thirty-eight college males drawn from undergraduate courses at the University of Kansas. Ss were tested in the spring of 1963 and each S was paid

$2.00 for participating in the study.

Procedures

The sample population for the present investigation consisted of two groups or "sub-samples." The first group of sixty-nine college men (Group I) were first examined on the individually administered Embedded-Figures Test (EFT) and then the group administered Hidden Figures Test (HFT) and the Otis Intelligence Test. The second sample of sixty-nine college men (Group II) were first given the HFT and Otis Test and then the EFT. Ss were randomly assigned to the two groups on the basis of availability. To minimize practice effects in analyzing embedded-figures, a minimum period of seven days between administration of individual and group measures of field-independence was maintained.

Since there was a possibility that the two groups might differ significantly in intelligence (Otis IQ) or in age, even though random assignment to the two groups was used, an analysis of these factors was undertaken. The mean ages, mean Otis IQ's and variances were calculated for Group I, Group II and the Combined Group Samples. The t and F-Tests were used to assess differences between the two groups. These data are presented in Table 1. The obtained t and F-values for age and Otis IQ's respectively indicate there were no significant differences between the two samples with respect to age or Otis Intelligence Test Scores.

[Insert Table 1 about here]

Some evidence has been reported which suggests practice effects in learning to analyze embedded figures (Jackson, 1956; Jackson et al, 1962). To evaluate this possibility, the means and variances for the Embedded

and Hidden Figures Test Scores were calculated for the two groups. The t and F-Tests were used to analyze these data. The results of these analyses are summarized in Table 2.

[Insert Table 2 about here]

Results in Table 2 show some evidence of practice effects with both groups: Group I Ss who received the Embedded-Figures Test first earned higher scores on the Hidden Figures Test than Ss in Group II who received the HFT first. Conversely, Group II Ss demonstrated somewhat more rapid solution time scores on the EFT than Ss in Group I. Although there is evidence of practice effects in analyzing both sets of embedded figures, results only attain statistical significance with the group administered Hidden Figures Test. The obtained F-values indicate there were no significant variance differences between the two groups on either measure of field-independence.

The two groups of sixty-nine college men of comparable age, Otis IQ and Embedded-Figures Test Scores constituted the sample to which all experimental procedures used in this study were administered.

Ss received the measures of Creative Thinking Abilities one month after the completion of administration of the EFT, HFT and Otis Intelligence Test. The entire sample was tested in large groups of forty Ss or more. Of the original sample of 138 Ss, 114 completed the creativity test battery. The remaining 24 Ss either broke their appointments or did not have the time to complete the final phase of the study.

S groups were formed as follows. The solution time scores on the 12 Embedded-Figures Designs were summed for each S and a Mean EFT Score

was calculated for each of the 138 college men tested. To reduce the tendency toward skewness among EFT Scores, each Ss mean score was converted to logs. Log EFT Scores were then plotted in a frequency distribution and interquartile ranges for this distribution of scores were calculated. The Log EFT Scores of individuals who earned relatively rapid solution time scores on the Embedded-Figures Test fell into the upper quartile of this distribution of scores. For purposes of this study, these individuals were designated as the Design Field-Independent Group. A second group consisted of college men whose Mean EFT Scores fell into the lower quartile of the distribution of scores. These individuals obtained the slowest solution time scores on the Embedded-Figures Test and were designated as the Design Field-Dependent Group. Finally, a third group of individuals whose EFT Scores fell into the mid-fifty per cent range of the distribution was identified. These Ss were designated as the Design Field-Central Group.

The demonstrated relationships between EFT performance and intelligence posed a problem for the present study. Ss EFT performance was used as the criterion of field-independence. Inasmuch as this measure has been shown to be highly correlated with intelligence test performance, it was conceivable that intelligence factors could confound any clear and/or unambiguous interpretation of results. Therefore, two different samples were drawn from the three S groups above. The first sample consisted of 3 groups of 15 Ss each, matched for Otis IQ and drawn from the Design Field-Dependent, Field-Central and Field-Independent Groups described above. The second sample was composed of 40 college males drawn at random from the larger 138 S population.

The rationale for selecting these two different subject samples was as follows. It was felt that the first sample of three matched groups would permit the comparison of the creativity test performance of Field-Dependent, Field-Independent and Field-Central Controls when the effects of Otis IQ were controlled by a matching procedure. On the other hand, data from the Random Sample would permit an empirical determination of the relationships between measures of field-independence and intelligence and group administered Hidden Figures Test and individually administered Embedded-Figures Test.

The procedures used in matching Field-Dependent, Field-Central and Field-Independent Ss on Otis IQ were as follows. The Otis IQ scores for the 138 men in the total sample population were plotted in a five level frequency distribution with Otis IQ scores ranging from 110-134. The percentage of the total sample falling in each of the five IQ levels was calculated. Fifteen Ss, matched for Otis IQ, were then drawn from the Field-Dependent, Field-Central, and Field-Independent categories so that the distribution of Otis IQ scores in the three groups approximated the distribution of Otis IQ in the overall sample population. These data are summarized in Table 3 below.

As can be seen from Table 3, this selection procedure permitted both a fair sampling of Otis IQ scores among college males and at the same time guaranteed some distribution of these effects throughout the three matched groups.

[Insert Table 3 about here]

The means and variances for age, Otis IQ and EFT raw scores were calculated for the three matched groups, and the fourth Field-Random Group

drawn from the overall population (N:138). Fourteen of these Ss were also in the matched groups described previously. These data are summarized in Table 4.

[Insert Table 4 about here]

The age and Otis IQ scores for the three matched groups are almost identical. Field-Centrals, however, show somewhat greater age variability than the other two matched groups. The similarity in performance on the Otis intelligence Test indicates a successful matching of the three groups on this variable. As would be expected, the three groups differ greatly in their EFT solution time scores. Field-Dependent college men evidence greater variability in their EFT scores than do matched Field-Central or Field-Independent Groups.

The age, Otis Intelligence, and log EFT scores for the three matched groups were analyzed by means of a Matched Subject Analysis of Variance Technique. The results of these analyses are summarized in Table 5.

From Table 5 we see there are no significant differences between matched Field-Dependent, Field-Central and Field-Independent college men with respect to age or Otis Intelligence. However, there are significant differences in Otis IQ within S groupings. These results reflect the investigators' efforts to sample the broad range of Otis IQ within the larger college sample studied. The significant differences between the three groups on Embedded-Figures Test performance are as expected. These results indicate that the operational procedures used in selecting Ss for the three groups were effective in discriminating individuals who differ with respect to performance on the measure of Design Field-Independence used in the study.

[Insert Table 5 about here]

RESULTS

Group Versus Individual Measures of Field-Independence and Their Relation to Measures of Intelligence Ability

One aim of the present study was to assess the relationship between the measures of field-independence and the intelligence test scores used in the present study. To do this, the log transformed Embedded-Figures, Hidden Figures Test Scores, Otis IQ, and SCAT Scores were obtained for the forty college males in the Field-Random Group. Pearson Product-Moment correlations were then used to measure the association between variables. These data are summarized in Table 6.

The scores from the individually administered Embedded-Figures Test and the group administered Hidden Figures Test are negatively and significantly correlated. The correlation coefficient between the two measures of field-independence reflects their structural similarity yet also indicates they are not equivalent or identical. The relatively high association between scores on measures of field-independence and Otis IQ fits expectations. There is no substantial correlation between group or individual measures of field-independence and Total or Verbal Scores from the Scholastic College Achievement Tests. However, both individual and group measures of field-independence are significantly correlated with the Quantitative Scale of the SCAT Test. Otis IQ scores are positively and significantly correlated with the SCAT Total Score. However, the significant but moderate relationship between Verbal and Quantitative aspects of the SCAT is somewhat lower than one might expect and may reflect the different processes tapped by the two scales.

[Insert Table 6 about here]

The hypothesis that Witkin's individually administered Embedded Figures Test would be negatively and significantly associated with Jackson's group administered Hidden Figures Test was confirmed. Both measures of field-independence are significantly correlated with factors commonly measured in intelligence tests. However, the degree of relationship between field-independence and IQ is partly determined by the loading of quantitative factors in the operational measures of intelligence employed. The high and significant relationship between Otis IQ Scores and the SCAT Scale Scores would indicate that the School and College Abilities Tests measure factors highly similar, if not identical, with those tapped by commonly used measures of intelligence.

Field-Independence and Creativity

The creativity test performance of the three groups of Field-Dependent, Field-Central, and Field-Independent subjects matched (N:15 per group) for IQ were analyzed for differences. A simple analysis of variance procedure was completed for each of the creativity test scores. There were fourteen scores and therefore fourteen analyses of variance were completed. No significant differences were obtained on any of the 14 scores. However, when the mean fourteen scores for each group (see Table &) were ranked and Kendall's coefficient of concordance (W) was performed, significant similarities occurred among rankings across measures. The coefficient for the ranks (W) = .40, S = 156.5, was significant at the .01 level. The conclusion was drawn that the Field-Independent Group was most creative on the aggregate of the 14 scores, followed by the Field-Dependent and the Field-Central Groups.

[Insert Table 7 about here]

The analyses of variance performed on the entire sample (N:114) for the three groups, Field-Independent, Field-Dependent, and Field-Central, unmatched for intelligence, revealed no significant differences on the fourteen creativity scores. Again the Kendall's coefficient of concordance (W) was performed for the means (see Table 8) and significant similarities in rankings appeared for the fourteen scores. The coefficient for the ranks (W) = .75, S = 294, was significant at the .01 level. Again the most creative group was the Field-Independent, followed by the Field-Central Group and the Field-Dependent.

[Insert Table 8 about here]

The intercorrelations of all the creativity scores and the remaining test scores for all 114 subjects are presented in Table 9. The correlations for the creativity scores concur with the pattern found in earlier studies (Mackler & Shontz, 1964b; 1965). Results on the creativity battery generally showed relatively high inter-test score variability and low intra-test score variability: i.e., correlations of scores comparable in nature, occurring on different tests (fluency, flexibility, originality, and elaboration) indicated that inter-test correlations were not uniformly high though usually reaching significance. The .05 level of significance was attained primarily because of the size of the sample (N:114) but the magnitude of the relationship is still weak.

The correlations of creativity scores and Otis IQ results were weak and typically non-significant. The range of coefficients was from -.01 to .33.

The correlations of creativity scores with the School and College Ability Test (SCAT) ranged from -.13 to .26 and were, in general, lower than the correlations with the Otis.

[Insert Table 9 about here]

Yamamoto in his view of literature (1961) and in a recent study (1964) finds similar results, with the correlation of measures for creativity and IQ low (usually .20 - .40).

The inter-correlation matrix was subjected to factor analysis. The Varimax method was used and the following factors were obtained: (1) six different creativity factors and (2) one factor composed of Otis IQ, SCAT, Embedded-Figures and Hidden Figures scores. The six creativity factors are primarily a result of four different tests, Ask and Guess, Circles, Decorations, and Tin Cans, each forming a factor. The factor analysis added further confirmation to these creativity scores being linked by test, rather than by factor (See Mackler & Shontz, 1964b). Since the Ask and Guess consists of sub-parts, two additional factors were obtained yielding the six creativity factors. The IQ factor is not surprising in that low correlations were obtained between creativity and these ability and perceptual tests while high correlations were obtained within these ability and perceptual measures.

DISCUSSION

The Relationship of Field-Dependent and Field-Independent Cognitive Styles to Creative Test Performance

H_1: College males who demonstrate a field-independent performance on the Embedded-Figures Test (EFT) will obtain significantly higher

creativity scores on the experimental measures of creative thinking abilities than will college males who demonstrate a field-dependent perceptual performance on the EFT.

Results confirm this hypothesis. Although none of the fourteen individual scores revealed significant differences, this is not surprising in view of the findings reported in a previous study by Mackler & Shontz (1965). These investigators used the same creativity battery with five groups of coed undergraduates: art and dance majors, physically and visually handicapped, and a control group. Although the art group scored highest, only on one score were significant differences obtained, the Circles originality score. Therefore, we would not expect any one score of the fourteen to predict creativity with field-independent subjects moreso than for art majors. We might have conjectured that the Circles originality score might have been the only isolated score to obtain significant differences. On this score, the field-independent group scored highest both when matched and unmatched for IQ. However, the F ratios in these comparisons were not significant.

Witkin (1964) suggests "that cognitive development must be viewed as embedded in personality personal history" (p. 204). Similar conclusions were drawn from the previously mentioned work of Mackler and Shontz (1965) dealing with life style and creativity. This personal history of life style as Adler (Ansbacher and Ansbacher, 1956) states is related to perceptual, intellectual and creative performance. Witkin concludes that his narrowly defined study of perception has extended to include broad and pervasive patterns of differences among individuals "in what seemed to add up to a 'style of life.'"[5] This study supports Witkin's findings adding another

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[5]See Mackler and Shontz (1964a) for a review of literature on life styles and creativity.

dimension to these broad differences in cognitive functioning, namely, that field-independent individuals are more creative than field-dependent ones.

Levy and Rokeach (1960), in agreement with Witkin, have extended his concepts. They state "that a person who is really 'field-independent' is a person who is not only able to 'separate item from field' but to recognize old fields into new ones" (p. 269). One logical extension of Witkin's idea of field-independence-dependence and of Levy and Rokeach is seen in Schachtel's (1959) writings about perceptual modes and creativity and in Tumin's (1954) discussion of creativity and conformity arising from a social context. In both Schachtel and Tumin we see the creative person developing differently, perceptually and socially, from the conforming indivudual in ways akin to Witkin's theorizing about field-independent and field-dependent individuals.

Schachtel described two perceptual modes that are critical to an understanding of his approach. The modes, autocentric, or subject-centered, and allocentric, or object-centered, are means for communication between subject and object. The autocentric mode predominated in infancy and childhood with the allocentric mode increasing in importance in adolescence and adulthood. In the autocentric mode the person does not objectify what he senses, the mode is predominantly sensual, pleasureful, and subjective; in the allocentric mode the person objectifies what he perceives with an emphasis on what the object is actually like.

Schachtel described creativity as the "art of seeing the familiar fully in its exhaustible being, without using it autocentrically for purposes of remaining embedded in it and reassured by it" (Schachtel, 1959, p. 184).

This is, in effect, the ability to remain perceptually open to the world, to encounter it, to be field-independent. Or as Schachtel put it, in "the existential struggle between the two tendencies in man: to remain open toward the world, capable of allocentric perception, or to seek the security of secondary embeddedness in a closed world and in the shared autocentricity of familiar perceptions" (Schachtel, 1959, p. 188). This appears to be the perception of the field-dependent individual. Creativity can occur when the former occurs, that is, when there is openness in the world.

The "openness to the world" which theorists attribute to creative individuals implies much more than being "sensitive to" or "moved by" environmental events. Sensitivity to the world of objects and other people is, in itslef, insufficient to generate and "carry" highly creative behavior. The field-dependent person shows an intense orientation and sensitivity to happenings in his environment. However, he is unable to stand apart, to separate himself from the nexus of embedding environmental influences. As Schachtel indicates above, creativity requires elements of independence and autonomy and a willingness to engage in an active struggle or encounter with the environment. Witkin (1962) asserts that it is just this inability to take an oppositional stance, to engage in this kind of struggle with the world of objects and other people which handicaps the field-dependent person in so many areas of his cognitive and emotive life.

Schachtel described the perceptual processes and their effects on creativity. He only alluded to the social and inter-personal forces that impinge on these two types of perceptual modes. Tumin (1954), however, in his writings has cogently described some of the social forces that act as obstacles to creativity. For Tumin, man is a social being who is oriented

toward the judgment of others regarding his personal and social worth. He forms an opinion of himself commensurate with what others think of him; he cannot develop an opinion arbitrarily or independently of these repeated evaluations. If a person begins to deny or ignore the evaluation of others, he tends to become marginal and deviant. Therefore, persons seek to be admired, to be respected by others, and they do not risk this security unless they have some resevoir of acquired status behind them.

Tumin contends that societal emphasis on status, and competition for status, makes it difficult for an individual to be both creative, hence different, and be socially-approved as well. What is approved of socially is usually what is done well, and not that which is novel or unique. Conformity is the means by which social acceptance is obtained. "The emphasis on individuality, difference, creativity, and the satisfactions of self-consummatory experiences are always at a handicap, so far as social support and social obstacles are concerned" (Tumin, 1954, p. 266). Tumin suggests that we need social reform to create a society where status-emphases are kept to a minimum and thereby encourage the possibilities for creativity to occur.

If present findings are valid, one may question some of the emphasis which theorists (Fromm, 1959; Kubie, 1958; Maslow, 1959; and Rogers, 1959) place upon the relationship between creativity and adjustment, especially if conformity is equated with adjustment. That is, in this investigation field-independent individuals were found to be consistently more creative than comparable groups of field-dependent and field-central peers. However, Witkin et al (1962) have been quick to indicate that a field-independent

cognitive orientation does not denote better adjustment, maturity or any other psychological virtues. Independent studies by a number of investigators substantiate this point. That is, descriptions of field-independent individuals, based upon their performance in a variety of research situations, characterize them as being: rebellious, non-conforming individuals who valued autonomy and independence even to the extent of being isolated from other people and as critical skeptics who were not easily impressed or influenced by others (Block, 1957); ambitious, intellectualized and overcontrolled persons who were concerned with theories and ideas rather than people (Pemberton, 1952; Bell, 1955; Witkin et al, 1962); "tough", unconventional individuals who were emotionally "cold," distant and uninterested in other people (Bell, 1955; Crutchfield and Starkweather, 1953; Crutchfield et al, 1958; Witkin et al, 1962). Although such characterizations would hardly fit modern conceptions of the mature or "fully functioning person," these individuals nevertheless demonstrated considerable capacity for creative expression.

Actually, such findings are consistent with our notions about highly creative individuals. That is, few of the creative giants of our era could be described as extremely well-adjusted. More often they have been unconventional, work-oriented persons who were emersed and "caught up" in their work moreso than in adapting always to societal mores (MacKinnon, 1965; Rank, 1932). For example, even as creative a person as Freud has been described (Fromm, 1963; Jones, 1953) as a highly eccentric and neurotic individual driven by a desire for greatness and an intense fear of mediocrity. Again, it is unlikely that Thomas Edison, who literally "lived" in his laboratory for months on end, or the shy and reticent Einstein or the

moody and brooding William Faulkner, all recognized as highly creative individuals, would be considered particularly well-adjusted in terms of modern standards. MacKinnon (1965) sums up this point nicely when he describes creative architects. "It is not that they are socially irresponsible, but their behavior is guided by esthetic values and ethical standards which they have set for themselves and which have been effectively integrated into their images of themselves and of their ideals (MacKinnon, 1965, p. 280."

Present findings raise more questions than they answer. However, these data do seem to suggest that maturity or adjustment need not be critical ingredients in creative expression.

Group and Individual Measures of Field-Independence and Their Relationship to Measures of Intellectual Ability

H2: College men who earn low solution time scores on the individually administered Embedded-Figures Test will tend to obtain relatively high scores on the group administered Hidden Figures Test. Conversely, college males who earn high mean solution scores on the EFT will tend to obtain low scores on the HFT.

The significant correlation between EFT and HFT found in the Random Group (N = 40) analyses confirm this hypothesis. The magnitude of the correlation coefficient (.55) between these two test scores reflects their structural similarity, yet indicates clearly that the two measures tap functions which are far from identical. The lack of equivalence between the two scales indicates that, while the group (HFT) procedure may be employed as a rough screening device, it cannot, at this point, be used as an accurate and reliable index of an individual's performance on the Embedded-Figures Test.

The correlation between individual and group measures of field-independence obtained in this investigation was considerably lower than the .84 reported by Jackson et al (1962). The differences obtained in the two studies may be due to several factors. First, the results in Jackson's study were based upon data obtained from both male and female subjects while the present findings were obtained from an exclusively male population. Women have been found (Witkin et al, 1954, 1962; Bieri et al, 1958; Bieri, 1960) to be consistently more field-dependent than men. It is conceivable that inclusion of female subjects would increase the range of scores on both measures and thereby increase the degree of association between tests. Secondly, Jackson used a group-administered modification of the Witkin EFT, whereas the present study used the individually administered Short Form of the Embedded Figures Test (Jackson, 1956) as the basic measure of field-independence. It is possible that the use of differing criterion measures contributed to the differences reported in the two investigations. However, irregardless of one's interpretation of the results, it seems apparent that further study of the relationships between Embedded and Hidden Figures Test performance will be necessary before the group HFT can be employed as an accurate measure of field-independence.

The results of the Random Group correlational analyses support the expected relationships between Otis IQ Scores and the measures of field-independence used in the study. Both the individual EFT and the group HFT measures were significantly correlated with Otis Intelligence Scores. These results are consistent with findings reported by other investigators (Jackson, 1956; Podell and Phillips, 1959; Woerner and Levine, 1950; Witkin et al, 1962) and demonstrate clear relations between field-dependent and

field-independent cognitive styles and the kinds of intellectual functions tapped by currently used intelligence tests.

Results obtained with the Schools and College Abilities Test (SCAT) provide some clarification of the relationship between field-dependence and intellectual functioning. That is, while the Embedded-Figures Test Scores correlated significantly with the Quantitative Scores from the Schools and College Abilities Test, the EFT showed no significant relationship with the scores from the Verbal Scale of the SCAT nor with SCAT Total Scores. A similar patterning of relationships was found with the Hidden Figures Test. Thus, field-independent individuals tended to obtain relatively high scores on tasks involving arithmetical reasoning and manipulation of number concepts while field-dependent ones tended to obtain consistently low scores on these kinds of tasks. These results are in agreement with data reported by Bieri et al (1958) indicating a significant relationship between EFT performance and ability to carry out straightforward arithmetical operations and with Rosenfeld's (1958) findings of a linkage between field-independence and effectiveness in complex operations requiring mathematical reasoning. Witkin et al (1962) have indicated such relationships might be expected on the basis of a common requirement for overcoming embedding contexts.

Similarly, the weak and insignificant correlations obtained between EFT performance and scores from the Verbal Scale of the SCAT are consistent with results of a number of studies (Goodenough and Karp, 1961; Podell and Phillips, 1958; Witkin et al, 1962) which found typically weak and insignificant relationships between measures of field-independence and tasks involving verbal skills and abilities.

It is not clear, from this study, whether tasks requiring arithmetical reasoning and manipulation of number concepts, in fact, involve "analytic" abilities. However, present findings appear consistent with the factor-analytic study reported by Goodenough and Karp (1961) and with Witkin's (1964) recent statement:

> . . .The significant relations previously reported between total IQ scores and measures for the body-adjustment test and other perceptual tests is "carried" primarily by those subtests of standard intelligence tests which in structure are similar to the perceptual tests of field-independence. In other words, the cognitive style we have been studying is tapped by some of the subtests of standard intelligence tests. (p. 179)

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TABLE 1

Distribution of Means and Variances of Age and Otis IQ Scores for Subjects in Group I, Group II, and Combined Group College Males Sample

	Mean Age	Variance	t	F	Mean Otis IQ	Variance	t	F	N
Group I	20.130	2.380	1.169	1.252	124.333	59.108	.687	1.069	69
Group II	20.159	1.901			124.449	55.310			69
Combined Groups	20.145	2.125			123.891	56.169			138

TABLE 2

Mean Embedded-Figures Test Scores, Hidden Figures Test Scores and Variance for Group I, Group II, and Combined Group College Male Sample

	Mean EFT Score	Variance	t	F	Mean HFT Score	Variance	t	F	N
Group I	42.055	791.580	.761	1.211	12.696	10.774	3.092*	1.379	69
Group II	38.575	653.530			10.812	14.861			69
Combined Groups	40.315	720.331			11.754	13.618			138

*Denotes significance at the .01 level of confidence.

TABLE 3

Comparison of Distribution of Otis IQ Scores in Overall Sample Population of College Males with Distribution of Same IQ Scores in Three Matched Groups of Design Field-Dependent, Field-Central, and Field-Independent College Males[a]

Level	Range of Otis IQ Scores	Sample Population Frequency	Distribution Percent	Matched Group Frequency	Distribution Percent
I	130-134	34	26	3	20
II	125-129	39	30	5	33
III	120-124	22	17	3	20
IV	115-119	23	18	3	20
V	110-114	12	9	1	7
		Sum 130	100	Sum 15	100

[a]Three additional levels (Otis IQ's of 135-139, 100-104, 105-109) and eight subjects were omitted from this comparison due to insufficient N's for matching.

TABLE 4

Means and Variances for Age, Otis IQ, and EFT Scores for Matched Field-Dependent Field-Central, Field-Independent, and Field-Random College Males

Groups	Mean Age	Variance	Mean Otis IQ	Variance	Mean EFT	Variance	N
Field-Dependents	20.600	1.114	123.733	31.924	77.104	708.594	15
Field-Centrals	20.333	3.095	123.713	34.638	38.429	38.297	15
Field-Independents	20.400	2.543	123.933	34.024	14.924	33.402	15
Field-Randoms	20.200	2.493	122.675	60.917	44.939	630.081	40

TABLE 5

Analysis of Variance of Mean Age, Otis IQ, and Log Embedded-Figures Scores Among Matched Field-Dependent, Field-Central, and Field-Independent College Males

Source	Sum of Squares	df	Mean Square	F
		Age		
Groups	.670	2	.335	.573
Subjects	20.863	14	1.490	.129
Residual	72.667	28	2.595	
Total	94.200	44		
		Otis IQ Scores		
Groups	.401	2	.201	1.322
Subjects	1404.532	14	100.324	660.026*
Residual	4.267	28	.152	
Total	1409.200	44		
		Log EFT Scores		
Groups	2.788	2	1.394	33.109*
Subjects	.453	14	.032	.762
Residual	1.182	28	.042	
Total	4.423	44		

*Denotes significance at the .001 level of confidence.

TABLE 6

Product-Moment Correlations between Embedded Figures Test Scores, Hidden Figures Test Scores, Otis IQ Scores, Total, Verbal And Quantitative Scores from the School and College Ability Test (SCAT) among Forty Randomly Selected College Males (N:40)

	2	3	4	5	6
1. Embedded-Figures	-.55**	-.34*	-.17	-.03	-.39**
2. Hidden Figures		.42**	.20	.14	.31*
3. Otis IQ			.77**	.63**	.72**
4. SCAT: Total				.88**	.78**
5. SCAT: Verbal					.42**
6. SCAT: Quantitative					

* Denotes significance at the .05 level of confidence.
**Denotes significance at the .01 level of confidence.

TABLE 7

Means of Creativity Scores for Field-Independent, Field-Dependent, and Field-Central Groups (N:15 per group) Matched for Intelligence

Creativity Score		Field-Independent	Field-Dependent	Field-Central
Ask and Guess	Fluency	32.2	31.8	33.3
	Adequacy	28.8	28.2	30.0
	Flexibility	21.0	20.4	20.5
Circles	Fluency	20.8	21.1	19.6
	Flexibility	10.2	10.6	9.4
	Originality	40.2	39.4	38.8
	Elaboration	22.0	19.6	20.8
Decorations	Fluency	23.0	20.1	18.4
	Flexibility	26.0	23.6	23.0
	Elaboration	32.6	27.3	22.0
	Originality	13.2	13.2	11.1
Tin Cans	Fluency	13.2	12.6	11.3
	Flexibility	10.2	9.1	7.9
	Originality	8.4	7.6	6.2

TABLE 8

Means of Creativity Scores for Field-Independent (N:31), Field-Dependent (N:36), and Field-Central (N:47) Groups Not Matched for Intelligence

Creativity Score		Field-Independent	Field-Dependent	Field-Central
Ask and Guess	Fluency	35.2	31.1	34.0
	Adequacy	31.1	28.0	29.6
	Flexibility	21.2	19.7	20.9
Circles	Fluency	22.1	19.6	19.9
	Flexibility	10.10	9.97	9.86
	Originality	42.5	36.8	40.2
	Elaboration	23.5	19.0	21.7
Decorations	Fluency	21.60	18.53	18.47
	Flexibility	25.5	22.0	25.0
	Elaboration	31.0	24.9	39.0
	Originality	13.4	11.2	12.8
Tin Cans	Fluency	13.8	11.8	12.2
	Flexibility	9.9	8.7	8.6
	Originality	8.5	6.9	7.0

TABLE 9

Intercorrelation (Pearson r) between Creativity Scores, Otis IQ Scores, SCAT Achievement Sc

			Ask and Guess		Circles				Decorations			
			2	3	4	5	6	7	8	9	10	11
Ask and Guess	1.	Fluency	.87**	.73**	.53**	.44**	.54**	.62**	.20*	.29**	.11	.17
	2.	Adequacy		.53**	.48**	.36**	.43**	.53**	.25**	.19*	-.04	.06
	3.	Flexibility			.33**	.37**	.44**	.45**	.18	.24**	.22*	.21*
Circles	4.	Fluency				.48**	.68**	.70**	.28**	.27**	.09	.17
	5.	Flexibility					.77**	.56**	.18	.29**	.21*	.26**
	6.	Originality						.81**	.29**	.40**	.27**	.34**
	7.	Elaboration							.32**	.30**	.28**	.29**
Decora-	8.	Fluency								.12	-.11	-.03
tions	9.	Flexibility									.45**	.86**
	10.	Elaboration										.47**
	11.	Originality										
Tin Cans	12.	Fluency										
	14.	Originality										
Otis IQ	15.											
SCAT	16.	Total										
	17.	Verbal										
	18.	Quantitative										
Embedded Figures	19.											
Hidden Figures	20.											

* Significant at or below the .05 level.
**Significant at or below the .01 level.

TABLE 9

IQ Scores, SCAT Achievement Scores, Embedded-Figures and Hidden Figures Scores (N:114)

Decorations				Tin Cans			Otis IQ	SCAT Total	SCAT V	SCAT Q	Emb. Fig.	Hidden Fig.
8	9	10	11	12	13	14	15	16	17	18	19	20
.20*	.29**	.11	.17	.58**	.52**	.44**	.16	-.09	-.09	.05	-.14	.25**
.25**	.19*	-.04	.06	.54**	.50**	.36**	.13	-.06	-.08	.08	-.12	.16
.18	.24**	.22*	.21*	.47**	.39**	.41**	.09	-.05	-.00	.00	-.04	.24**
.28**	.27**	.09	.17	.39**	.41**	.35**	.20*	.04	.06	.07	-.14	.10
.18	.29**	.21*	.26**	.32**	.32**	.36**	.11	-.13	-.13	-.03	-.06	.02
.29**	.40**	.27**	.34**	.48**	.44**	.53**	.23*	.01	.07	.01	-.23*	-.19*
.32**	.30**	.28**	.29**	.47**	.42**	.45**	.25**	-.00	.03	.06	-.31**	.21*
	.12	-.11	-.03	.33**	.33**	.30**	.30**	.09	.11	.11	-.22*	.32**
		.45**	.86**	.25**	.25**	.33**	.18	.07	.14	.00	-.28**	.21*
			.47**	-.03	.01	.09	-.01	-.04	.08	-.10	-.14	.06
				.24**	.21*	.34**	.20*	.17	.26**	.07	-.20*	.19*
					.08**	.84**	.23*	.07	.06	.09	-.16	.25**
						.80**	.21*	.02	.04	.08	-.17	.27**
							.33**	.23*	.26**	.11	-.20*	.28**
								.65**	.56**	.64**	-.52**	.43**
									.86**	.73**	-.38**	.24**
										.41**	-.26**	.17
											-.40**	.30**
												-.51**